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ABSTRACT

Electric Circuits 540-126 is the second course of a three-course sequence which is taken during the first year of the two-year program in Electrical-Electronic Engineering Technology at Cuyahoga Community College (Ohio). The conventional lecture method of instruction includes textbook and other reading assignments, lectures based on the readings and homework problems, one to three tests, and a final exam. The individualized instruction method utilizes a modified Personalized System of Instruction (PSI) format including ten modules, audio tapes, a study guide, one 50-minute lecture per module, a test given by tutors every week, two bonus tests given by the instructor, and a final exam. This study was conducted to determine if this individualized instruction method decreases student attrition rates and provides the student with comparable preparation for Electric Circuits 540-127 as the 540-126 course taught by the conventional method. A higher percentage of students enrolled in the individualized instruction sections passed the course, compared to students enrolled in the conventionally taught sections; they also received a significantly higher percentage of B's and a significantly lower percentage of C's. They performed as well in 540-127, and 88.1 percent of those enrolled in the individualized instruction sections of 540-126 said they would choose the same method for 540-127. (DC)

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A COMPARISON OF USING INDIVIDUALIZED INSTRUCTION AND CONVENTIONAL LECTURE TECHNIQUES IN THE LECTURE SECTION OF ELECTRIC CIRCUITS 540-126

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A Comparison of Using Individualized Instruction and Conventional Lecture Techniques in the Lecture Section of Electric Circuits 540-126

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Abstract - The purpose of this research study was to compare individualized instruction and conventional lecture techniques in the lecture section of Electric Circuits 540-126. Electric Circuits 540-126 is the second course of a three course sequence which is taken in the first year of the two-year program in Electrical-Electronic Engineering Technology at Cuyahoga Community College. The only prerequisite is Electric Circuits 540-125. Individualized instruction using a modified PSI format has been used in one day section of 540-125 each quarter since the Fall of 1972, and used in the day 540-126 course during the 1973-74 school year. Individualized instruction and conventional lecture techniques were compared in the following three areas: Percentage of students who passed, frequency of grades in 540-126 and frequency of grades in the third circuits course, Electric Circuits 540-127. It was found that the percentage of students who passed the individualized instruction sections was higher, but not significantly higher than the conventional lecture section. The frequency of grades received in 540-126 were dependent upon the method of instruction used. There was a significantly higher percentage of B's and significantly lower percentage of C's in the individualized instruction sections. The frequency of grades received in 540-127, the next sequential circuits course, were independent of the method of instruction used in 540-126.

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I. THE TITLE

A Comparison of Using Individualized Instruction and Conventional lecture Techniques in the Lecture Section of Electric Circuits 540-126.

II. THE STATEMENT OF THE PROBLEM

Does individualized instruction in the lecture section of Electric Circuits 540-126 aid students in successfully completing Electric Circuits 540-126? Do a higher percentage of students pass the Electric Circuits 540-126 course in which individualized instruction was used? Is there a significant difference in the grades obtained in Electric Circuits 540-126 by the students who had individualized instruction and those who were taught by the conventional lecture methods? Is there a significant difference in the grades obtained in Electric Circuits 540-127 by the students who had individualized instruction and those who were taught by conventional lecture techniques in Electric Circuits 540-126?

III. THE HYPOTHESES

1. There is a higher percentage of students who pass the Electric Circuits 540-126 course in which individualized instruction was used than the Electric Circuits 540-126 course in which conventional lecture techniques were used.
2. There is a significant difference in the frequency of grades obtained in Electric Circuits 540-126 by the students who had individualized instruction and those who were taught by the conventional lecture techniques.
3. There is no significant difference in the grades obtained in Electric Circuits 540-127 by the students who had individualized

instruction and those who were taught by the conventional lecture techniques in Electric Circuits 540-126.

IV. BACKGROUND AND SIGNIFICANCE OF THE STUDY

For this section in the Applied Educational Research and Evaluation Module the writer made an extensive literature search for results of the Personalized System of Instruction (PSI), also known as the Keller Plan. (1, pp. 2 - 9) The results will not be repeated here, however a brief summary will be given:

The grade distribution went from a generally normal curve for the conventional lecture control groups to an upside down normal curve for the PSI or Keller groups. Most of the authors emphasized that the number of A's and B's increased significantly. In several of the PSI or Keller groups, in addition to the number of A's and B's being high the number of withdrawals were high, however only one paper discussed this point. This point is important to the writer because this was one reason for using individualized instruction, that is to reduce attrition rate.

In several engineering courses using the PSI or Keller Plan, the final examination results of the PSI or Keller groups were significantly higher than the control groups. It was also found that the PSI or Keller groups retained their knowledge longer and spent less time on the course. Also most students prefer the PSI or Keller Plan over the conventional lecture courses.

The Electric Circuits course at Cuyahoga Community College is

a three quarter sequence course made up of Electric Circuits 540-125, 540-126 and 540-127. It is the beginning course in the Electrical-Electronic Engineering Technology two-year degree program. Since Electric Circuits 540-125 is a beginning course with no stated prerequisites the students have always comprised a very heterogeneous group. The only prerequisite for the 540-126 course is 540-125.

Some form of individualized instruction seemed to be the only way to accomodate the number of students in the lecture, approximately 48, and the diverse backgrounds of the students. The writer took the initiative to prepare instructional materials for 540-125 on her own time during the Summer of 1972 and the 1972-73 school year. The school supported development of instructional materials for the second course, 540-126 during the Summer of 1973 and the 1973-74 school year.

The individualized instruction material is based on a modified PSI or Keller Plan, see definition of terms section. The individualized instruction is currently only being tried in the lecture portion of the courses. The laboratory section of each course, which is two hours per week, is run the conventional way. Laboratory reports are required, the number of reports is determined by the instructor.

During the Applied Educational Research and Evaluation Module, the writer compared individualized instruction and conventional lecture techniques in the lecture section of Electric Circuits 540-125. Individualized instruction and conventional lecture techniques were compared in the following five areas: percentage of students who passed, percentage of marginal students who passed, mean final examination grades, frequency of grades in 540-125 and

frequency of grades in the second circuits course, Electric Circuits 540-126. It was found that the percentage of students who passed the individualized instruction sections was significantly higher than the conventional lecture section. There was no significant difference in the percentage of marginal students who passed these sections. The final examination results of all the individualized instruction sections were significantly higher than the conventional lecture control group. The frequency of grades received in 540-125 were independent of the method of instruction used. During the Winter 1974 quarter it was found that the grades received in the next sequential circuits course, 540-126, were independent of the method of instruction used in 540-125. Therefore it was found that the major objectives of the individualized instruction program were met, that is to decrease student attrition rate and to provide the student with at least the same background for the 540-126 course as did the 540-125 course taught by the conventional lecture method.

The developed instructional materials for the 540-126 course have been used by the writer in the day sections during the 1973-74 school year. It is the objective of this study to determine if the system of individualized instruction currently being tried decreases the student attrition rate and provides the student with at least the same background for 540-127 as does the 540-126 course taught by conventional methods. The results of this study, together with the results of the previous study on 540-125, will determine the direction of the future work in the Electric Circuits 540-125, -126 and -127 courses. The results will provide information to answer such questions as is the current system of individualized instruction

fulfilling the objectives, should the current system be modified or is the conventional lecture method still the best? Some insight to the answers to the following two questions may be gained by examining the results: Should the Electric Circuits 540-127 course be taught by individualized instruction methods similar to those used in 540-125 and 126? Should individualized instruction be developed for the laboratory sections?

V. DEFINITION OF TERMS

The following terms are used repeatedly in this paper. They may be unique to Cuyahoga Community College, so they are defined as follows:

Electric Circuits 540-125: A three quarter credit hour course with two hours lecture and two hours laboratory per week offered at Cuyahoga Community College. There is no prerequisite required for this course. The 1973-74 Cuyahoga Community College Catalogue description is as follows: "Direct current circuit fundamentals with emphasis on electron theory or current flow, electrical quantities and their units of measurement, sources of EMF, Ohm's law, electrical energy and power relationships. Series, parallel and series-parallel circuits, voltage dividers. Kirchhoff's laws, Thevenin's and Norton's theorems. Practical laboratory experience in the construction of working circuits and the evaluation of their performance." This course is required in the Electrical-Electronic Engineering Technology and Mechanical Engineering Technology two year Associate Degree Programs. It may be taken by anyone in the college.

Electric Circuits 540-126: A three quarter credit hour course with two hours lecture and two hours laboratory per week offered at Cuyahoga Community College. The only prerequisite for this course is Electric Circuits 540-125. The 1973-74 Cuyahoga Community College Catalogue description is as follows: "Fundamentals of alternating current circuits with emphasis on capacitance, inductance, sinusoidal voltage and current, reactance, vectors and phasors, impedance. Practical laboratory experience with A.C. instruments including oscilloscopes, capacitance testing and the evaluation of reactive circuits." This course is required in the Electrical-Electronic Engineering Technology and is an elective in the Mechanical Engineering Technology two year Associate Degree Programs. It may be taken by anyone in the college as long as they have the prerequisite.

Electric Circuits 540-127: A three quarter credit hour course with two hours lecture and two hours laboratory per week offered at Cuyahoga Community College. The prerequisite for this course is Electric Circuits 540-126 and 690-105 Trigonometry. However if a student has done well in 540-126, the department may permit him to take 540-127 without the trigonometry requirement; the circuits courses are sequential, so a student could forget much course content if he must skip a quarter or two making up the math requirements. The 1973-74 Cuyahoga Community College Catalogue description is as follows: "Continuation of 540-126 Electric Circuits. Emphasis on power, resonance, coupled circuits, transformer action and harmonics. Practical laboratory experience with various combinations of series and parallel

reactive circuits, resonant circuits and transformers."

This course is required in the Electrical-Electronic Engineering Technology two year Associate Degree Program. It may be taken by anyone in the college as long as they have the prerequisites.

Grade Point Average (GPA): A student's grade based upon a four-point system.

No Pass: One of the following grades:

incomplete (I) this must be removed by the fifth week of the next quarter or it becomes an F.

withdraw (W) either a student may withdraw from a course or an instructor may withdraw a student through the eighth week of a quarter.

no grade (X) A few no grades have been given in the past years. The X can no longer be used by instructors.

failure (F)

Conventional Lecture Method: Students are assigned to read certain material and to work various problems from the text book. The instructor lectures on the reading material and/or problems for two 50 minute periods each week of the quarter. During the quarter there are usually one, two or three one-hour tests and a final exam. The number of tests and homework problems required are determined by the instructor.

Individualized Instruction: The required work for the quarter is broken down into units, also called modules or minicourses. There are eight required units in 540-125 and ten units in 540-126. The instructional material is based on a modified PSI or Keller Plan, see references 2 and 3 for a description of the

Keller Plan. Audio tapes are available for all but one of the required units in the 540-125 course, and three units of 540-126 have audio tapes. However the main source of direction through the unit or minicourse is the very thoroughly written study guide. The study guides are so complete that little use is made of the text book. It is called modified because lectures are still given on each unit, about 50 minutes per lecture, and problem/help sessions are held during other scheduled lecture time. Testing occurs in the 540-125 course about every [illegible] weeks, with no tutors used for testing. Tests are given at a rate of once per week in the 540-126 course, with the tutors giving the mastery part. The instructor gives two bonus tests during the quarter. Final examinations are still required in both courses. The lectures are still considered motivational, because if a student completes the unit before the scheduled lecture he is excused from it.

VI. LIMITATIONS OF THE STUDY

The following limitations may affect the general use of the results of this study:

1. The findings may only be important to Cuyahoga Community College and may be significant only to the Electrical-Electronic Engineering Technology Department of the College.
2. There was no provision made to hold constant the variable of instructors; therefore some instructors may have different backgrounds, teaching techniques and use different grading systems.
3. No provision was made to include motivational factors as a controlled variable.
4. No provision was made to obtain a typical control group.
5. No provision was made to include laboratory performance. However laboratory reports are included in the determination of the course grade.
6. No provision was made to analyze the data according to previous grades in 540-125 or 540-126, to high school background, previous or concurrent math courses, previous electronics experience, previous military service, numbers of credit hours carried or number of hours spent working either full or part-time on a job outside of class.

VII. BASIC ASSUMPTIONS

The following basic assumptions were made for this research project:

1. The conventional lecture and individualized instruction sections were considered homogeneous.
2. All the instructors of Electric Circuits 540-125, -126 and -127 were equally competent.
3. All the instructors of Electric Circuits 540-125, -126 and -127 used equivalent grading procedures.
4. Successful completion of Electric Circuits 540-125 meant a student should be able to successfully complete Electric Circuits 540-126. Successful completion of Electric Circuits 540-126 meant a student should be able to successfully complete Electric Circuits 540-127.

VIII. PROCEDURES FOR COLLECTING DATA

The following procedures were used to collect data for this research project:

1. To determine the percentage of students who passed the day sections of Electric Circuits 540-126 using the conventional lecture method for the lecture sections, computer grade print out sheets and instructor's grade books for the school years 1970-71, 1971-72 and 1972-73 were used.
2. To determine the percentage of students who passed the Electric Circuits 540-126 course in which individualized instruction was used, computer grade print out sheets and instructor's grade books for the 1973-74 school year were used.

3. To determine if there was a significant difference in the frequency of grades obtained in the conventional and individualized instruction sections of Electric Circuits 540-126, computer grade print out sheets for the conventional day sections of the 1972-73 school year and the individualized instruction sections of the 1973-74 school year were used.

4. To determine if there was a significant difference in the grades obtained in the third electric circuits course, 540-127, by the students who had individualized instruction and those who were taught by the conventional lecture method in 540-126, computer grade print out sheets were physically reviewed, compared and traced. Students in the 540-127 classes for the 1973-74 school year were traced back into the 540-126 classes to see if they had conventional lecture or individualized instruction classes.

IX. PROCEDURES FOR TREATING DATA

The following procedures were used to treat the data for this research project:

Hypothesis 1

The difference between the percentage of students who passed the individualized instruction and conventional lecture sections is zero.

H_o: $P_I = P_C$

H_a: $P_I > P_C$

$\alpha = 0.05$

I (individualized instruction)
C (conventional lecture)

The z-Test was used to determine if the percentage in the individualized instruction sections was significantly higher. The critical z value (one-tailed test) is 1.645, therefore if $z > +1.645$ the H_o would be rejected and H_a accepted.

Hypothesis 2

There is no significant difference in the frequency of grades obtained in Electric Circuits 540-126 by the students who had individualized instruction and those who had the conventional method of instruction. H_o: $G_I = G_C$

H_a: $G_I \neq G_C$

$\alpha = 0.05$

The letter grades could be considered interval data, however they were not normally distributed therefore the grades were treated as ordinal data as frequency of grades. They were arranged in the order A, B, C, D and no pass. The Chi Square (X^2) Test was used to determine if there was a significant difference. For a contingency table of five rows and two columns, there are four degrees of freedom. The critical X^2 value is 9.49, therefore if $X^2 > 9.49$ the H_o would be rejected and H_a accepted.

Since there was a significant difference, the z-Test was used to determine if the percentage of B's and the percentage of C's in the individualized instruction sections were significantly higher or lower than those in the conventional lecture sections.

B grades	C grades
H_o: $P_{B\underline{I}} = P_{B\underline{C}}$	H_o: $P_{C\underline{C}} = P_{C\underline{I}}$
H_a: $P_{B\underline{I}} > P_{B\underline{C}}$	H_a: $P_{C\underline{C}} > P_{C\underline{I}}$
$\alpha = 0.05$	$\alpha = 0.05$

The critical z value (one-tailed test) is 1.645, therefore if $z > +1.645$ the H_o would be rejected and H_a accepted.

Hypothesis 3

There is no significant difference in the frequency of grades obtained in Electric Circuits 540-127 by the students who had individualized instruction and those who were taught by the conventional lecture method in 540-126.

H_o: $G_I = G_C$

H_a: $G_I \neq G_C$

$\alpha = 0.05$

The letter grades could be considered interval data, however they were not normally distributed therefore the grades were treated as ordinal data as frequency of grades as in hypothesis 2. The Chi Square (X^2) Test was used to determine if there was a significant difference. The critical X^2 value for four degrees of freedom is 9.49, therefore if $X^2 > 9.49$ the null hypothesis H_o would be rejected and the alternate hypothesis H_a accepted. There were two comparisons made. The first compared the frequency of grades obtained by day classes in 540-127 for the 1973-74 school year. Since all classes in 540-127 are still taught using the conventional lecture method, the second comparison of frequency of grades included all students, both day and night, for the 1973-74 school year.

X. RESULTS

The results of each hypothesis are listed separately.

Hypothesis 1

Table 1 lists the number and percentage of students who have passed the day conventional lecture sections of Electric Circuits 540-126 for the 1970-71, 1971-72 and 1972-73 school years. Examination of the percentage passed for the school year column, shows that this figure remained relatively constant for these three school years. Using just the last two years, there is a slight decrease in the number of students who passed.

Table 1

The Number and Percentage of Students Who Passed the Day Sections of Electric Circuits 540-126 Using Conventional Lecture Techniques

Quarter	No. of Students who Passed	Total in Class	% who Passed	% Passed for School Year
Fall 1970	9	16	56.25	
Winter 1971	19	29	65.52	
Spring 1971	19	26	73.08	
				66.20
Fall 1971	20	29	68.97	
Winter 1972	32	53	60.38	
Spring 1972	29	35	82.86	
				69.23
Fall 1972	16	21	76.19	
Winter 1973	30	47	63.83	
Spring 1973	23	39	58.97	
				64.49
Totals	197	295	66.78	

Table 2

The Number and Percentage of Students Who Passed the Day Sections of Electric Circuits 540-126 Using Individualized Instruction

Quarter	No. of Students who Passed	Total in Class	% who Passed
Fall 1973	17	27	62.96
Winter 1974	41	53	77.36
Spring 1974	28	36	77.78
Totals	86	116	74.14

Totals Table 1 and Table 2 $z = 1.45$
School years 1972-73 and 1973-74 $z = 1.564$

Table 2 lists the number and percentage of students who have passed the day sections of Electric Circuits 540-126 using individualized instruction. Using the overall total percentage figures from Table 1 and Table 2 and testing at the 0.05 significance level, it was found that the percentage of students who passed the sections in which individualized instruction was used was higher but not significantly higher than the percentage of students who passed the sections in which the conventional lecture method was used. A comparison of the total percentage for the 1972-73 school year from Table 1 with the total percentage from Table 2 showed that the number of students who passed the individualized instruction sections was higher but not at the 0.05 significance level (was 0.06).

Hypothesis 2

Table 3 shows the observed frequency of grades obtained by the conventional lecture sections during the 1972-73 school year and the individualized instruction sections during the 1973-74 school year.

Table 3

The Observed Frequency of Grades Received in the Conventional Lecture Sections (1972-73 School Year) and the Individualized Instruction Sections (1973-74 School Year) of Electric Circuits 540-126

Grades	Conventional Lecture	Individualized Instruction	Totals	z
A	30	31	61	
B	15	42	57	3.797*
C	19	10	29	2.027*
D	5	3	8	
No Pass	38	30	68	
	107	116	223	
				$X^2 = 16.8721$*

*Significant at the 0.05 level.

Using the Chi Square (X^2) Test and testing at the 0.05 significance level, it was found that the frequency of grades received in Electric Circuits 540-126 was dependent upon the method of instruction used. The significance level was actually 0.01.

From the results of the z-Test, it was also found that the percentage of B grades received in the individualized instruction sections during the 1973-74 school year was significantly greater (at the 0.0005 level) than those received in the conventional lecture sections during the 1972-73 school year. The percentage of C grades received in the conventional lecture sections was significantly

greater (at the 0.025 level) than the percentage in the individualized instruction sections.

Hypothesis 3

Table 4 shows the observed frequency of grades received in the day sections of Electric Circuits 540-127 for those students who had conventional and individualized instruction in Electric Circuits 540-126. The results are for the 1973-74 school year. All classes in Electric Circuits 540-127 are still taught using the conventional lecture method.

Table 4

The Observed Frequency of Grades Received in the Day Conventional Lecture Sections of Electric Circuits 540-127 for the 1973-74 School Year

Grades in 540-127	Fall -126 Conv.	Fall -126 Indiv.	Winter -126 Conv.	Winter -126 Indiv.	Spring -126 Conv.	Spring -126 Indiv.	Totals Conv.	Totals Indiv.	Grand
A	2	0	1	2	4	8	7	10	17
B	4	0	2	2	0	7	6	9	15
C	2	0	1	3	0	4	3	7	10
D	1	0	0	3	0	2	1	5	6
No Pass	9	0	0	1	0	5	9	6	15
	18		15		30		26	37	63

$X^2 = 4.2095$

Since the individualized instruction in 540-126 did not start until the Fall of 1973, as observed in Table 4 no students in the Fall 540-127 class had a background of individualized instruction. The students listed under the Winter and Spring columns of Table 4, as having a conventional lecture background in 540-126, came from

the night sections or from the day classes during the 1972-73 school year.

Using the Chi Square (X^2) Test and testing at the 0.05 significance level, it was found that the grades received in the next sequential circuits course, 540-127, were independent of the method of instruction used in the lecture section of circuits 540-126.

Since the writer had a conventional lecture section in 540-126 at night during the Winter Quarter and a 540-127 section at night during the Spring Quarter, it was decided to also look at the frequency of grades received in the night sections of 540-127. These results are given in Table 5. The students listed under the individualized instruction column under the Spring Quarter were from the writer's day class of 540-126 held during the Winter Quarter.

Table 5

The Observed Frequency of Grades Received in the Night Conventional Lecture Sections of Electric Circuits 540-127 for the 1973-74 School Year

Grades in 540-127	Fall -126 Conv.	Fall -126 Indiv.	Winter -126 Conv.	Winter -126 Indiv.	Spring -126 Conv.	Spring -126 Indiv.	Totals Conv.	Totals Indiv.
A	6	0	4	0	6	0	16	0
B	1	0	4	0	7	4	12	4
C	1	0	1	0	3	3	5	3
D	1	0	0	0	2	0	3	0
No Pass	3	0	5	0	6	2	14	2
	12		14		33		50	9

Table 6

The Observed Frequency of Grades Received in Electric Circuits 540-127 for the 1973-74 School Year (Tables 4 and 5 Combined)

Grades in 540-127	540-126 Conventional Lecture	540-126 Individualized Instruction	Totals
A	23	10	33
B	18	13	31
C	8	10	18
D	4	5	9
No Pass	23	8	31
	76	46	122

$X^2 = 6.4857$

The results from Tables 4 and 5 were combined to make Table 6. Using the Chi Square (X^2) Test and testing at the 0.05 significance level, it was found that the grades received in the next sequential circuits course, 540-127 for both day and night sections of the 1973-74 school year, were independent of the method of instruction used in the lecture section of circuits 540-126.

XI. CONCLUSIONS AND SIGNIFICANCE

Conclusions

The major objectives of the individualized instruction program for both the 540-125 and 126 courses were to decrease the student attrition rate and to provide the student with at least the same background for the 540-127 or 540-126 course as did the 540-126 or 125 course taught by the conventional lecture method. The results found under Hypothesis 1 show that the percentage of students who passed the sections in which individualized instruction was used was higher but not significantly higher than the percentage of students who passed the sections in which conventional lecture methods were used. The actual level was the 0.06 significance level, whereas the criterion for rejecting the null hypothesis of no difference and accepting the alternative hypothesis was the 0.05 significance level.

The results under Hypothesis 2 show that the grades received in Electric Circuits 540-126 were dependent upon the method of instruction used. In particular, there was a significantly higher percentage of B's and significantly lower percentage of C's in the individualized instruction sections. Even though the attrition rate (no pass) in the individualized instruction sections did not drop significantly, it did drop. The individualized instruction permitted the average or C student to move up to the good or B catagory. There was no significant change in the percentage of A's or D's.

The results under Hypothesis 3 showed that the distribution of grades received in the 540-127 circuits course was independent of the method of instruction used in 540-126. Therefore the individualized instruction used in 540-126 did improve the course. More students

go on to 540-127 and it hasn't significantly affected the over-all distribution of grades.

Therefore the total results under the three hypotheses show that generally the objectives of the individualized instruction have been fulfilled. This doesn't mean that continued experimentation and evaluation shouldn't continue. The attrition rate is still too high.

Residual Findings

A questionnaire was given to the students in the individualized instruction sections of 540-126, a copy of this questionnaire appears in Appendix 1. This questionnaire is given out the last week of school and is turned-in in random order at the final exam. One of the key questions on it was question 11: "For the next Circuits Course, if there were two sections available, one taught the conventional lecture method and the other section taught using self-paced units, which would you take? Conventional method (____) Self-paced units (____)". The results of this question are tabulated in Table 7.

Table 7

Results of 540-126 Questionnaire

Quarter	No. of Students who Answered Question 11	No. of Students who Said Self-Paced Units	% who Said Self-Paced Units
Fall 1973	17	17	100
Winter 1974	41	36	87.8
Spring 1974	26	21	80.8
Totals	84	74	88.1

Since the questionnaire was completed at the end of the course, and by students who had made it, it would be expected that the results would be slanted toward the self-paced units (individualized instruction). No comments have been received from the 30 of the 116 students who did not pass the individualized instruction sections. Most of the 30 students either dropped or were withdrawn by the instructor for excessive absenteeism. This is a very important area for future study.

Also during the last week of the Spring Quarter another questionnaire was given to the students who had completed Electric Circuits 540-126 using individualized instruction during the Winter or Fall Quarters. A copy of this questionnaire appears in Appendix 2. Thirty five copies were distributed, however only 21 were returned because most of the students were not in the writer's classes during the Spring Quarter.

One of the key questions on this questionnaire was question 7: "Should the 127 Circuits course be broken down into units, and study guides prepared? yes (____) no (____) Give reasons for your answer: a) b) ". The results of question 7 are given in Table 8.

Table 8

Results of a Questionnaire Given to Former 540-126 Students

Yes	No	Both	Total
17	2	2	21

The students who indicated both, that is they checked both yes and no, said that study guides would help over the first half of the course. If the both is included with yes, then 90% of the students who returned the questionnaire said yes.

Further Studies

As will be discussed under Future Projects, the content of the lecture sections of 540-127 will be broken down into units so that individualized instruction similar to that used in 540-125 and -126 may be used. The writer will be teaching the day section of 540-127 this Fall using individualized instruction. The results of this trial should be evaluated.

The attrition rate has decreased in the individualized instruction sections of 540-125 and -126, however it is still high. Further study should be made about the students who do not pass. For example, if it is found that most of the students that do not pass 540-125 also do not pass their other courses, then further improvement of 540-125 may be just a waste of time and money. The whole program or something else must be changed.

There has been no experimenting in the night sections of Electric Circuits. Some problems are common between both day and night, so using individualized instruction for the lecture sessions may help. However trying to use individualized instruction at night would present many problems also; this is an area that requires further study. Some experimenting will be done this Fall, see Future Projects section.

Future Projects

The writer feels that further experimentation, especially at the 540-125 level is the biggest need. What ever is done to reduce the attrition rate in 540-125 will probably work in the 540-126 course. As a result of this module on Curriculum Development, the writer has decided that to do something with the attrition rate a big change should occur. Now that the lecture portion of 540-125 is broken down into units or minicourses, with audio tapes available, the step to complete individualization of the whole course, both lecture and lab, would not be too big to take. Therefore this Fall Quarter the writer has received permission to completely individualize one evening section of 540-125. It was decided to try an evening section for the following reasons:

1. The evening section is limited to 24 to 28 students, whereas the lecture sections during the day usually have 50 students.
2. The night classes are run for four hours one night a week. It was thought that this block of time would be easier to work with than the two one-hour lecture and two hour laboratory periods per week for the day student. The night class runs from 6 to 10 PM, the class room could be opened at 5 PM or possibly 4 PM to allow more time.
3. No experimenting has been done with the night classes.
4. In the past couple years the attrition rate at night has been slightly higher than the day rate.

As a result of the good results found in the research studies the last two quarters, the writer has received three equivalent credit hours this Summer to continue the individualization of instruction

into the 540-127 course. This time will allow the writer to break down the content of the lecture part of the 540-127 course into units. Short study guides will then be prepared for each unit. These study guides will not be as complete as those in 540-125 and -126. They will rely on the text book, in fact they are meant to get the student back into the text book. The study guides will contain objectives, instructions about reading and problems in the text, clarifications, possibly some examples and sample test questions.

REFERENCES

1. Taber, Margaret R., "A Comparison of Using Individualized Instruction and Conventional Lecture Techniques in the Lecture Section of Electric Circuits 540-125," A Practicum Presented to Nova University in Partial Fulfillment of the Requirements for the Degree of Doctor of Education, 4/2/1974.

2. Keller, Fred S., "Goodbye, Teacher . . .," Journal of Applied Behavior Analysis, Vol 1, Spring 1968, pp. 79-89.

3. Green, B. A., Jr., "Physics Teaching by the Keller Plan at MIT," American Journal of Physics, Vol. 39, No. 7, July 1971, pp. 764-775.

126 Electric Circuits Questionnaire
(Self-Paced Units)

Do not sign your name.

1. Which of the following Study Guides did you use? Also show what you think of them.

Units	Did you Use?	Big Help	OK	No Help
Capacitance	( )	( )	( )	( )
Inductance	( )	( )	( )	( )
Time Constants	( )	( )	( )	( )
AC & Sine Wave	( )	( )	( )	( )
Reactance	( )	( )	( )	( )
Vector Algebra	( )	( )	( )	( )
RC & RL Circuits	( )	( )	( )	( )
RLC Circuits	( )	( )	( )	( )
Parallel Circuits	( )	( )	( )	( )

2. Discuss what you think of the Study Guides. Which ones should be revised so that they are more helpful? Which ones should have more examples?

3. Did the text book help you understand the course material?

Very helpful (___) Some (___) Very little (___)

4a. Which of the following Tapes did you use? Also show what you think of them.

Units	Did you Use?	Big Help	OK	No Help
Capacitance	( )	( )	( )	( )
Inductance	( )	( )	( )	( )

b. If tapes were available for all the units, would you use them?

Yes (___) No (___)

c. If you said yes for b, would you prefer using tapes: Library (___)

Engr. Tech Office (___) Borrow cassette for home use (___)

d. What would you prefer on the tapes?

Discuss problems only (___) Discuss complete unit (___)

5. Self-paced instruction works best with no lectures at all (___)

1 hour lecture/week (___) 2 hours lecture/week (___)

6. Did lectures help you understand the material?

Very helpful (___) Some help (___) No help (___)

OVER

7. Which method of testing do you prefer?

Short quizes each week & final (___) Mid-term & final (___)

Tests every other week (double length of short quiz) & final (___)

8. Grading - Rate the importance of the following factors in limiting your grade.

Factor	Had Strong Effect	Some Effect	No Effect
Amount of time required	( )	( )	( )
Bad exam taker	( )	( )	( )
Difficulty of material	( )	( )	( )
Poor teaching	( )	( )	( )
Lack of interest	( )	( )	( )
Not enough contact with instructor	( )	( )	( )

9. Time spent on the following - List hours/week.

Total time spent (___) hours/week
In class with lectures and help-quiz sessions (___) hours/week
Outside of class on Study Guides (___) hours/week
Outside of class on lab (___) hours/week
Outside of class with text book (___) hours/week
Total time spent relative to other classes:
Much more (___) About the same (___) Less (___)

10. General attitude about the course

	Yes definitely	OK	No
Was the material interesting?	( )	( )	( )
Did you enjoy the time spent with the Study Guides?	( )	( )	( )
Did you enjoy contact with other students in class?	( )	( )	( )
Was the course well taught?	( )	( )	( )
Did you know what was expected of you?	( )	( )	( )
Was the course coherent as a whole?	( )	( )	( )

Was there less grade anxiety than with the conventional course?
Yes (___) About the same (___) No, more (___)
General appraisal of the course: Good (___) Average (___) Bad (___)

11. For the next Circuits Course, if there were two sections available, one taught the conventional lecture method and the other section taught using self-paced units, which would you take?

Conventional method (___) Self-paced units (___)

12. List three suggestions (include the method) for improving the course:

a.

b.

c.

Thank you for your time and help.

UNIVERSITY OF CALIF.
LOS ANGELES

MAY 30 1975

CLEARINGHOUSE FOR
JUNIOR COLLEGE
INFORMATION

126 Circuits Questionnaire — Do not sign your name

To the students who used a modified form of individualized instruction (with Study Guides) in Electric Circuits 540-126. Now that you have almost completed your course in Electric Circuits 540-127, will you please complete this questionnaire about the preparation you received for 127. Your help will improve the 126 course. Thank you for your time and help. Mrs. M. Taber

1. What method of instruction did you have in Circuits 125?
   Conventional lecture (____) Minicourses or units (____) Other (Explain) (____)

2. The Circuits 126 course was broken down into units, with a short test on each unit. On the questionnaire completed at the end of 126, most students said they preferred the course this way.
   Did you feel this way? yes (____) no (____)

   If you said yes, do you still feel this way?
   yes (____) no (____)

   Comments:

3. Were the Study Guides received in 126 helpful to you in 126?
   yes (____) no (____)

4. Did you use the Study Guides from 126 in 127 for reference or review? yes (____) no (____)

5. Do you feel that the 126 course gave you sufficient preparation for the 127 course? yes (____) no (____)

6. What are your suggestions for improvement for the 126 course?
   a)

   b)

   c)

7. Should the 127 Circuits course be broken down into units, and study guides prepared? yes (____) no (____)

   Give reasons for your answer:
   a)

   b)

Any additional comments you would care to make, please make them on the back.